PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Michael Lynn Hinds
Examiner: Roger L. Pang
Serial No.: 09/881,115 Group Art Unit 3681
Filed: 06/14/2001 (Atty. Ref. No. 15745-US)
For: MAGNETIC PROTECTION FOR HYDRAULIC SEAL

Moline, IL 61265
17 December 2004

APPEAL BRIEF

The Honorable Commissioner
of Patents and Trademarks
Washington, D.C. 20231
Sir:

Real Party in Interest

The real party in interest is Deere & Company to whom this application was assigned by the applicant per the assignment document recorded in the United States Patent and Trademark Office on 06/14/2001 at REEL/FRAME 011917/0657.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Amendments

A first amendment, filed on 21 November 2002, was entered in its entirety and considered in a first Final Rejection, dated 22 April 2003 and in a second Final Rejection, dated 21 November 2003. A second amendment , filed on 12 April 2004 was entered in its entirety and considered in an Office Action dated 06/10/2004. A third amendment, filed on 26 July 2004, was entered in its entirety and considered in a third Final Rejection, dated 09/15/2004. A fourth amendment, filed on 08 November 2004, was entered in its entirety and considered in an Advisory Action, dated 11/30/2004.

Status of Claims

Claims 1, 3-9, and 11-16 are pending in this application.

Claims 1, 3, 4, 9, 11 and 12 stand rejected.

Claims 5-8 and 13-16 stand objected to as being dependent upon a rejected base claim.

This appeal is from the rejection of claims 1, 3, 4, 9, 11 and 12.

A copy of the appealed claims is set forth in the attached Appendix.

Summary of the Invention

The present invention, as defined in the appealed claims, resides in the combination of: 1) a gear box having a low section having a bottom wall, a rotatable shaft extending through the bottom wall and being coupled to gearing, and a seal located for preventing oil from leaking along an interface including a surface section of the shaft where it enters the bottom wall, with 2) a contaminant collector having a magnetic characteristic mounted in the gear box in a location closely adjacent a top surface of the seal so as to intercept and collect ferric contaminants before they engage the seal.

Referring to FIGS. 1, there is shown a typical transmission 10 used for driving the cutting blades 22 of a pair of base cutting assemblies 18 of a sugar cane harvester. The gear box 12 of the transmission includes a shallow, horizontal upper section 14 which is joined to a pair of well sections 16.

Referring now also to FIGS. 2 and 3, it can be seen that each of the base cutting assemblies 18 includes a vertical drive shaft 20 which extends upwardly through a bottom wall of a given well section and 16 has an upper end section supported for rotation in an upper wall of the gear box 12. Located in the upper section 14 of the gear box 12, and respectively mounted to the tops of the drive shafts 20, are gears 32 and 34, these gears being respectively meshed with a pair of meshed idler gears 32. Respectively located about the shafts 20 and pressed into respective openings provided in the bottoms of the gear box well sections 16 are a pair of sleeves 48. Provided for sealing the interface between each shaft 20 and the associated sleeve 48 is a seal 52 made of an elastomeric material. Pressed onto each shaft 20 at a location just above the seal 52 is a contaminant collector 52.

Referring also to FIG. 4, it can be seen that each contaminant collector 52 is

in the form of a ring 56, which is U-shaped in vertical cross section, whereby a channel is formed. The bight of the channel is provided with a plurality of angularly spaced holes 60 to permit the flow of oil through them. Located within the channel and fixed to the bight at locations between the holes 60 are a plurality of magnets 58.

In operation, any ferric contaminants which result from gear wear, for example, will gravitate into the wells 16 and be attracted by the magnets 58 before reaching the seals 52. This will prevent the seals 52 from being abraded by contaminants, which, in the absence of the contaminant collectors 54, would be carried about by the rotating drive shafts 20 at their respective interfaces with the associated seal 52.

Issue

1. Are claims 1, 3, 4, 9, 11 and 12 unpatentable under 35 U.S.C. 103(a) as being obvious over Lehde in view of Moskowitz?

Grouping of the Claims

Rejected claims 1 and 9 are each independent claims.

Claim 3/1 is independently allowable, while 4/3 will stand or fall with claim 3.

Claim 11/9 is independently allowable, while claim 12 will stand or fall with claim 11.

Arguments as to the Issue

Issue

It is submitted that the rejection of claims 1, 3, 4, 9, 11 and 12 as being unpatentable under 35 U.S.C. 103(a) as being obvious over applicant's admitted prior art in view of Lehde and Moskowitz et al. is untenable.

Specifically, the Examiner proposes that it would have been obvious to one skilled in the art to have **modified the gearbox of applicant's prior art admission** by employing the contaminant collector of Lehde in order to collect metal particles and then **to modify** Lehde by mounting the contaminant collector for rotation on the shaft, i. e., interchanging the spiral groove portion 63 and the magnet 60 of Lehde in view of the teaching of Moskowitz et al. It is respectfully submitted that this rejection is in error as the environments of Lehde and Moskowitz et al. are far different from each other and from that in which applicant's claimed contaminant collector, as set forth in each of independent claims 1 and 9, is employed and it is not seen how

teachings from these sources would have made obvious the proposed combination.

The known environment, set forth in each of claims 1 and 9, in which applicant's claimed contaminant collector is used is that of a gear box having a bottom wall including a low section through which a rotatable drive shaft, that is coupled to gearing, extends, with a seal being provided between the drive shaft and the bottom wall for preventing leakage along the shaft, and with the contaminant collector having a magnetic characteristic and being mounted for rotation with the drive shaft at a location closely adjacent a top surface of the seal.

As concerns Lehde, the environment in which the so-called contaminant collector is employed is a that of a magnetic clutch or brake. With reference to the embodiment depicted in FIG. 1, the clutch/brake includes a first shaft 1 having a hat-like tubular casing 2 fixed to a bottom end thereof and a cylindrical core 3 located within and secured to the top of the casing 2 so as to define an annular passage 5 between the casing 2 and core 3 and joined to a cavity 5' located beneath the core 3. The casing 2 and core 3 are both made of **magnetizable** material and an electro-magnet 9, in the shape of a toroid, is supported within a space defined by the intersection of top and side walls of the tubular casing 2 and a reduced diameter top portion of the core 3. The bottom of the tubular casing 2 is fixed to the top of a bearing housing 6. **A second shaft** 15, made of **magnetizable** material, is located in axial alignment with the shaft 1 and is mounted for rotation in the bearing housing 6 by axially spaced, upper and lower bearings 16 and 17, with the upper bearing being located in the bottom end of a stepped bore provided in the top portion of the bearing housing 6. A bearing seal 20 is provided directly above the upper bearing 16 for retaining liquid and solid lubricants within a magnetic assembly 50, which is located within a cylindrical cavity provided in the top of the bearing housing 6 and includes lower and upper magnetic pole rings 52 and 53 disposed in sandwiching relationship to a magnetic ring 51 which is disposed about a non-magnetic spacer ring 54. A drag cup 11 is mounted to the top of the second shaft 15 and has a bottom wall 13 located within the cavity 5' and joined to an annular side wall 12 that extends into the annular cavity 5. The cavity 5, 5' is filled with a flowable magnetic material c which may comprise a mixture of lubricating oil and magnetic powder or particles, with or without a solid lubricant, or magnetic powder with a solid lubricant, or dry magnetic powder only (see column 5, lines 51-56). The clutch/brake is activated so as to effect a magnetic coupling between the upper shaft 1 and the

lower shaft 15 by energizing the electro-magnet 9 which causes the flowable magnetic material c to be magnetized so as to effect a magnetic attraction between the drag cup 11, carried by the lower shaft 15, and the tubular casing 2 and core 3, carried by the upper shaft 1. In order to keep magnetic particles **of the flowable magnetic material** away from the seal 20, the lower shaft 15 is provided with a helical rib 57 located within the toroidal magnet assembly 50, and having a hand which results in an upward screwing action that insures that the magnetic particles move upward away from the sealing ring 20 and are ejected upward into the cavity 5'. Thus, it is clear that if Lehde did not use a flowable magnetic material there would be no need for the toroidal magnet assembly 50; and it is also clear that the flowable magnetic material c **is not a contaminant**, but rather is a necessary part of the magnetic brake/clutch assembly. Further, it is clear that the assembly 50 does not actually collect magnetic particles, in the sense that applicant's claimed device collects contaminants, but rather acts to **convey** magnetic particles away from the seal 20.

As concerns Moskowitz et al., there a variety of embodiments of dynamic lip seals 32 are disclosed, which are located in fixed relationship to a rotatable shaft 10. The lip seal may itself be made from materials to form a permanent magnet, or a separate permanent magnet may be used with the lip seal in such a way that ferrofluid is retained at the lip of the seal so as to lubricate the wear region and exclude particulate contaminants, especially those which are non-magnetic, from the wear region. Thus, it is clear that the magnets in these embodiments do not act to **collect contaminants** but rather act to attract the ferrofluid, with the ferrofluid acting to exclude other fluid and particulate contaminants from the seal region. This ferrofluid may be painted onto the shaft 10 and the radial lip 32 or be provided within porous foam forming part of the seal assembly, as shown in FIGS. 15A and 16, for example. In FIGS. 13A, 13B ad 13C, respective embodiments are shown which utilize separate magnets that are fixed for rotation with the shaft 10.

It is clear that the flowable magnetic material c disclosed by Lehde and the ferrofluid disclosed by Moskowitz et al. are vastly different materials and that the principles of operation of the two are much different. Specifically, Lehde does not want any magnetic particles of the flowable magnetic material c to find their way to the interface between the shaft 37 and the seal 20, while Moskowitz et al. clearly want the ferromagnetic material to be located at the interface between the shaft 10

and the lip of the seal 32. Further, it is clear that neither Lehde or Moskowitz et al. are directed to the idea of **collecting contaminants with a member having a magnetic characteristic** as is the case with applicant's claimed structure. In Lehde, the magnetic particles are **conveyed away** from the seal 35 while the oil part of the mixture is permitted to provide lubricant for the seal 20. In Moskowitz et al., the magnet acts to retain the ferrofluid in place at the seal interface with the shaft so that contaminants are excluded from the seal interface due to the fact that the interface is already occupied by the ferrofluid.

Accordingly, since the toroidal magnet assembly 50 of Lehde is intended for use with a **magnetic clutch/brake assembly** for excluding magnetic particles of the **flowable magnetic material** c used to effect the clutch/brake coupling between the two parts which rotate relative to each other, and this exclusion is done by **conveying** the magnetic particles away from the seal, rather than **collecting contaminants** by using a collector having a magnetic characteristic, it is not thought that it would have been obvious to have looked to Lehde for a teaching of a **contaminant** collector for use in an environment having nothing to do with flowable magnetic materials for effecting a brake/clutch function. Even if it is assumed that it would have been obvious to have considered Lehde to be pertinent art for teaching the claimed contaminant collector, then it would not have been obvious to have looked to Moskowitz et al. for a teaching to mount the magnetic assembly 50 to the shaft 15 and to place the ribs 56 on the bearing housing since no benefit would result from such a modification, and no **collection of contaminant** would result, since any collected particles would merely be **conveyed** away from the seal. It is also noted that the bearing housing 6 of Lehde is **non-magnetic** and any modification to change the mounting of the magnetic assembly 50 would be complicated by this fact, which further goes away from such a modification being obvious. Further, since Moskowitz et al. teaches using the member with the magnetic characteristic to attract the ferrofluid so as retain it in place at the lip of the seal for excluding contaminant particles from the seal lip, it is not thought that it would have been obvious to one skilled in the art to have looked to Moskowitiz for a teaching of how the magnetic member should be mounted in an arrangement where particles are being conveyed away from the seal.

Thus, for the various reasons set forth above, claims 1 and 9 are thought clearly allowable. Since claims 3 and 4 depend respectively directly and indirectly

from claim 1, and claims 11 and 12 depend respectively directly and indirectly from claim 9, claims 3, 4, 11 and 12 are also thought allowable.

Each of claims 3 and 11 are thought to be allowable for the reason that they require the contaminant collector to include a ring press fit onto the drive shaft, and no such ring is thought taught by either Lehde or Moskowitz et al.

For the reasons stated above, appellant respectfully requests that the Examiner's rejection of claims 1, 3, 4, 9, 11 and 12 be reversed.

Please note that on or about 07 July 2003 (this is the date stamped on the self-addressed postcard sent in with the Appeal Brief) appellant filed an appeal brief with respect to the above-identified application and appellant instructed that the fee for filing the appeal brief be charged against Deposit Account 04-0525. **Thus, it is respectfully submitted that no further fee should be due as a result of filing this paper and appellant requests that the previously charged fee be applied here**. In the event that an additional amount is required because of fee increases, the additional amount may be charged against Deposit Account 04-0525. Two duplicates of this page are enclosed.

Respectfully,

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APPENDIX

Appealed Claims

1. In a gearbox containing gearing and having a low section having a bottom wall, a rotatable drive shaft extending through said bottom wall and being coupled to said gearing, and a seal located for preventing oil from leaking along an interface including a surface section of the shaft where it enters said bottom wall of the gearbox, the improvement comprising: a contaminant collector having magnetic characteristics being mounted in said gearbox for rotation with said shaft in a location closely adjacent a top surface of said seal so as to intercept and collect ferric contaminants before they engage the seal.

3. The gearbox as defined in claim 1 wherein said contaminant collector includes a ring press fit onto said shaft.

4. The gearbox defined in claim 3 wherein said magnetic characteristic is achieved by there being at least one magnetic component fixed as an integral part to an upper surface of said ring.

9. In a sugar cane base cutter assembly including a gearbox provided with an upper, horizontal section extending between and joining a pair of depending wells, each well having a bottom wall, an upper drive shaft section of a base cutter leg being rotatably mounted in each bottom wall, and a seal being located on each shaft section at an associated bottom wall for preventing leakage of oil from said gearbox along the shaft section, the improvement comprising: a contaminant collector having a magnetic characteristic being mounted for rotation with an associated one of said shaft sections at a location above and closely adjacent each seal so as to intercept ferric contaminants settling towards the associated seal.

11. The base cutter assembly defined in claim 9 wherein said contaminant collectors each include a ring press fit onto said associated one of the shaft sections.

12. The base cutter assembly defined in claim 11 wherein said magnetic characteristic of each contaminant collector is achieved by at least one magnet being fixed to each ring.